

# MICRO-G NEXT 2017 DESIGN CHALLENGES

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## Challenge: Anchoring Device

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### **Background**

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. Some of the destinations of interest are celestial bodies with milligravity to microgravity.

The small amount of gravity makes it challenging to remain on the surface. It is necessary to develop devices that can attach or grip to the surface.

One challenge is that the internal structures of these celestial bodies vary and are not well understood. Is the body monolithic or a rubble pile? What types of rocks with what porosity make up the body?

### **Objective**

Design and manufacture a device that can anchor to a celestial body in microgravity.

### **Requirements**

1. Your device shall be able to sample from the provided sampling platform. Please refer to Micro-G NExT [Sampling Platform](#) Presentation for descriptions of the sampling platform.
2. The device shall remain anchored in the simulants without the use of an operator.
3. The device shall remain anchored in the simulants when pulled upward with a 15 lb force.
4. Mass and volume of the device should be minimized.
5. The device can be operated manually or under power. Powered operations shall be driven pneumatically.
6. The device can have multiple parts that can attach and detach.
7. The device (all parts, in stowed configuration) shall fit within a 10" x 10" x 18" volume.
8. The device (all parts) shall have a dry weight less than 20 lbs.
9. The device shall be ambidextrous.
10. The device and any removable components shall have a tether attachment point 1" in diameter.
11. The device shall be compatible with a chlorine water environment.

## Challenge: Subsurface Sampling Device

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### **Background**

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. Some of the destinations of interest are celestial bodies with milligravity to microgravity.

A sample type of interest to scientists is a subsurface sample. Subsurface samples can showcase the history of the body and describe its internal structure.

### **Objective**

Design and manufacture a device that enables an astronaut to obtain a subsurface sample in microgravity.

### **Requirements**

1. Your device shall be able to sample from the provided sampling platform. Please refer to Micro-G NExT [Sampling Platform](#) Presentation for descriptions of the sampling platform.
2. The device shall be able to collect cylindrical samples 1" in diameter and 8" deep.
3. The device shall obtain a subsurface sample from solid rock and bins of regolith. The bins will contain mixtures of unconsolidated sand and rock fragments <0.25" in diameter. The solid rock will be sandstone or a comparable rock.
4. The device shall maintain the stratigraphy of the regolith and rock during collection, containment, and transportation.
5. The device shall minimize cross contamination between samples.
6. The device shall allow for removal of samples for verification that the stratigraphy is maintained.
7. The device can be operated manually or under power. Powered operations shall be driven pneumatically.
8. The device can have multiple parts that can attach and detach.
9. The device (all parts, in stowed configuration) shall fit within an 8" x 8" x 18" volume.
10. The device (all parts) shall have a dry weight less than 15 lbs.
11. The device shall be ambidextrous.
12. The device and any removable components shall have a tether attachment point 1" in diameter.
13. The device shall be compatible with a chlorine water environment.

## Challenge: Surface Sampling Device

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### **Background**

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. Some of the destinations of interest are celestial bodies with milligravity to microgravity.

A sample type of interest to scientists is a surface sample. A surface sample is the collection of the top layer (approximately 1 mm deep) of particulate resting on a larger body.

### **Objective**

Design and manufacture a device that enables an astronaut to collect a surface sample in microgravity.

### **Requirements**

1. The sample collection area shall measure 9 in<sup>2</sup>.
2. The device shall be capable of collecting samples from dust size particles up to 0.125" diameter spheres.
3. The device shall allow the operator to remain at least 18" from sampling area.
4. The device shall be capable of obtaining at least two samples.
5. The device shall minimize cross contamination between samples.
6. The device shall use only manual power.
7. The device can have multiple parts that can attach and detach.
8. The device (all parts, in stowed configuration) shall fit within an 8" x 8" x 18" volume.
9. The device (all parts) shall have a dry weight less than 15 lbs.
10. The device shall be capable of one-handed operation.
11. The device shall be ambidextrous.
12. The device and any removable components shall have a tether attachment point 1" in diameter.
13. The device shall be compatible with a chlorine water environment.